

REMARKS

The applicants acknowledge the Examiner's withdrawal of the 35 U.S.C. § 103(a) rejections based on Ilardi et al. (U.S. Pat. No. 5,466,389) in view of Kern of the previous office action mailed 1/10/03.

In the current Office Action, the pending claims were rejected on new grounds. Claims 27-28 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Kashiwase et al. (U.S. Pat. No. 5,378,317) in view of Sehested et al. (J. Phys. Chem.). In addition, claims 29-33 and 35 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Heyns et al. (New Wet Cleaning Strategies for Obtaining Highly Reliable Thin Oxide) in view of Sehested et al. (J. Phys. Chem.). Claims 27-33 and 35 are directed to methods for removing organic contaminants from a substrate.

Kashiwase et al. teaches a two step photo resist film cleaning process comprising (1) immersing the film in a mixed solution of sulfuric acid and hydrogen peroxide followed by (for a substrate such as silicon) (2) rinsing with an aqueous ozone solution to remove remaining residue not removed by the first step. Kashiwase et al., col. 4, lns. 22-36. According to the Office Action, Heyns et al. teaches a wet cleaning process for silicon substrate, wherein (1) an oxide is grown on the substrate to be cleaned using ozonated deionized water, followed by (2) removal of the formed native oxide and drying of the substrate. See Office Action, p. 4. The Examiner agrees that both Kashiwase et al. and Heyns et al. are silent regarding the addition of an additive that acts as a scavenger. See Office Action, pp. 3 and 4. Thus, there is no dispute that both Kashiwase et al. and Heyns et al. fail to disclose the introduction of an additive such as acetic acid to an aqueous ozone solution. The only issue is whether the teaching of Sehested et al. that acetic acid stabilizes aqueous ozone bridges the gap between (a) Kashiwase et al.'s teaching of a method using water and ozone (or Heyns et al.'s teaching of a method using formation and removal of an oxide) and (b) the presently claimed method comprising water, ozone, and an additive that acts as a scavenger.

While Sehested et al. teaches that acetic acid stabilizes aqueous ozone, neither it nor Kashiwase et al., nor Heyns et al., make any connection between ozone stabilization and the ability of aqueous ozone to clean organic contaminants from a substrate. That is, none of the cited art suggests that stabilization of ozone would lead to increased cleaning efficiency as observed by the present inventors. Indeed, none of the cited art teaches or suggests that ozone decomposition plays any

significant role in diminishing the cleaning efficiency of aqueous ozone. Without a recognition that ozone decomposition diminishes the cleaning efficiency of aqueous ozone, there can be no motivation to stabilize the ozone and, therefore, no motivation to combine the references as the Examiner has done. See, e.g., *In re Sang Su Lee*, 277 F.3d 1338, 1343 (Fed. Cir. 2002).

Furthermore, whether ozone stabilization would lead to increased cleaning efficiency depends on a number of factors. These factors include, but are not limited to, the rate of cleaning, the rate of ozone decomposition, and the degree to which the ozone stabilizer decreases the rate of ozone decomposition and the relation of the decreased rate to the rate of cleaning. For instance, if the rate of cleaning were much faster than the rate of ozone decomposition (i.e., cleaning was essentially completed before significant amounts of ozone decomposed), stabilization of the ozone would be expected to have essentially no effect on the cleaning efficiency. Without a teaching of these factors, one of ordinary skill in the art would neither be motivated to employ a scavenger nor have a reasonable expectation that adding a scavenger to an aqueous ozone solution would lead to an increased cleaning efficiency, as observed by the inventors for the presently claimed methods.

Without a showing that the prior art can be modified or combined with a reasonable expectation of success, the Examiner cannot establish that the present invention is obvious in light of the prior art. *In re Merck & Co.*, 800 F.2d 1091 (Fed. Cir. 1986). An acknowledged difference between the cited art and the present claims is that Kashiwase *et al.* teaches a cleaning step using aqueous ozone without a scavenger additive whereas the claimed method comprises cleaning using aqueous ozone with a scavenger additive. The specification presents a study comparing the cleaning efficiency of aqueous ozone without acetic acid as a scavenger (such as taught by Kashiwase *et al.*) to the method using acetic acid as a scavenger (as recited in the present claims). The experiments show that the presently claimed method provides an enhanced cleaning efficiency of 50% of implanted positive resist wafers, of up to 50% of un-implanted negative resist wafers, and of up to 88% of un-implanted positive resist wafers. Specification pp. 16-18 ("Application 2"). The prior art simply fails to provide any teachings or suggestion from which the ordinary artisan could reasonably have expected to observe the vastly improved cleaning capability of the present invention. Without this reasonable expectation of success, the prior art can not render the present invention obvious. *Merck*, 800 F.2d. at 1091.

In view of the foregoing, the applicants respectfully request reconsideration and withdrawal of all pending § 103 rejections.

With respect to the provisional obviousness-type double patenting rejections, the applicants acknowledge that the Examiner indicated that a terminal disclaimer has been filed but, as of the mailing date of the current Office Action, had not yet been matched with the file.

If there are any questions or comments regarding this Response or application, the Examiner is encouraged to contact the undersigned attorney as indicated below.

Respectfully submitted,

Date: April 8, 2004


Michael S. Greenfield
Registration No. 37,142

Telephone: 312-913-0001
Facsimile: 312-913-0002

McDonnell Boehnen Hulbert & Berghoff
300 South Wacker Drive
Chicago, IL 60606